Applying this formula to absorption in helium of a wave-length just shorter than 0.0004 A, we have $\tau/\rho = 0.0017$ per gram, while Compton's formula for σ/ρ gives 0.0018 per gram, so that the total absorption coefficient μ/ρ is 0.0035 per gram. For a wave-length just above 0.0004 A, μ/ρ is 0.0018.

A fourth way of satisfying condition (*b*) is to suppose that initially we have four protons and one electron at rest and a second electron moving with velocity βc, a helium nucleus at rest and a quantum being produced. The solution of this problem gives $\lambda = 0.0008$ A and $\beta = 0.9995$. The interest in this particular process is that the inverse process is similar to the photelectric effect of X-rays in that, when a quantum of $\lambda = 0.0008$ A strikes a helium nucleus, an electron is ejected with a velocity $\beta = 0.9995$ and the remainder of the nucleus splits up into four protons and one electron. For a wave-length just shorter than 0.0008 A in helium τ/ρ is now 0.0065 per gram, making $\mu/\rho = 0.0101$ per gram if Compton's eq. (1) is used.

[1] R. A. Millikan, *Science*, Nov. 20, 1925.

[2] A. H. Compton, *Physic. Rev.*, **21**, 483 (1923).

[3] J. J. Thomson, *Conduction of Electricity through Gases*, 2nd Ed., p. 325.

[4] G. E. M. Jauncey, *Physic. Rev.*, **22**, 233 (1923).

[5] J. H. Jeans, *Nature*, Dec. 12, 1925.

[6] A. H. Compton, *Physic. Rev.*, **22**, 409 (1923).

[7] Compton and Simon, *Ibid.*, **26**, 289 (1925).

[8] Hughes and Jauncey, *Nature*, Feb. 6 (1926).

[9] In our letter to *Nature*, $\lambda = 0.0018$ A is reported instead of $\lambda = 0.00043$ A. The former is in error.

A NEW KIND OF TEST OF THE CORRESPONDENCE PRINCIPLE BASED ON THE PREDICTION OF THE ABSOLUTE INTENSITIES OF SPECTRAL LINES

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The *correspondence principle* postulates a relation between the average rate at which energy is actually being discontinuously emitted by quantum transitions and the continuous rate of emission which would be calculated on the basis of the classical theory. In the field of atomic and molecular behavior the principle has hitherto only been used to predict what spectral lines will not occur at all and to predict the *relative intensities* of spectral lines of similar origin. Since, however, the classical theory permits a calculation of absolute rates of energy emission it should be possible to calculate from the correspondence principle the *absolute intensities* of spectral lines.

It was the purpose of the work described in this note to subject the correspondence principle to this new kind of more absolute test. Suitable data for the kind of test proposed are difficult to find owing to lack of precise knowledge of the intensities of most spectral lines, lack of knowledge of the number of atoms or molecules involved in the production of the lines and lack of knowledge as to the atomic or molecular model responsible for the lines. The recent beautiful work of Czerny,[1] however, on the spectrum of hydrogen chloride in the far infra-red provides us with at least approximate information as to the intensities of lines Nos. 8, 9 and 10 in the pure rotational spectrum of this dipole rotator, while the number of molecules involved in the production of the lines can be calculated from the Maxwell-Boltzmann distribution law as applied to rotating molecules with half quantum numbers and the measurements of Zahn[2] of the dielectric constant of hydrogen chloride gas coupled with the calculations of Pauling[3] give us the electric moment of the rotating molecules.

The results obtained can best be expressed by comparing the experimental values of Einstein's absorption coefficient B_{ij} calculated from Czerny's measurements with the theoretical values of B_{ij} calculated from the correspondence principle. For the three lines Nos. 8, 9 and 10 the calculated experimental values were 5.6, 6.8 and 10.6×10^{16} and the calculated theoretical values were 11.9, 11.8 and 11.6×10^{16}, all in c.g.s. units. For the lines in question the application of the correspondence principle treating the rotators as degenerate systems with only one quantized degree of freedom, or treating them as systems which have been made non-degenerate by spatial quantization in a weak external (magnetic) field as proposed by Kemble[4] lead to nearly the same results.

The deviations between the theoretical and experimental values of B_{ij} are possibly greater than could be accounted for by experimental error. Nevertheless, when the difficulties of the experimental work of Czerny and Zahn and the complexity of the calculations involved are considered, the approximate agreement seems satisfactory. The results considerably increase our confidence in the correspondence principle, justify us in subjecting it to further tests and lead us to hope that a precise quantitative formulation of the principle will ultimately be found.

The details of the method of calculation together with further discussion will be published in the *Physical Review*.

[1] Czerny, *Zts. Physik.*, **34,** 227 (1925).

[2] Zahn, *Physic. Rev.*, **24,** 400 (1924).

[3] Pauling, *Proc. Nat. Acad. Sci.*, **12,** 32(1926).

[4] Kemble, *Physic. Rev.*, **25,** 1 (1925).